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CATTLE ENTERING A PLUNGE DIP ON A QUEENSLAND PROPERTY.

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Editor: C. W. Winders, B.Sc.Agr.

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Berkshire.

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V. V. Radel, Coalstoun Lakes
H. R. Stanton, Tansey, *via* Goomeri
L. Stewart, Mulgowie, *via* Laidley
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O. J. Horton, "Manneum Brae" Stud, Manneum, Kingaroy.

Tamworth.

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A. C. Fletcher, "Myola" Stud, Jimbour
Salvation Army Home for Boys, "Canaan" Stud, Riverview
A. J. Surman, "Namrus" Stud, Noble road, Goodna
Department of Agriculture and Stock, Regional Experiment Station, Kairi
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F. N. Hales, Kerry road, Beaudesert
T. A. Stephen, "Withcott," Helidon
W. F. Kajewski, "Glenroy" Stud, Glencoe
A. Herbst, "Hillbanside" Stud, Bahr Scrub, *via* Beenleigh
H.M. State Farm, Numinbah
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
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R. H. Coller, Tallegalla, *via* Rosewood
A. J. Potter, "Woodlands," Inglewood
D. V. and P. V. Campbell, "Lawn Hill," Lamington
S. Kanowski, "Miecho" Stud, Pinelands
N. R. Potter, "Actonvale" Stud, Wellcamp

Wessex Saddleback.

W. S. Douglas, "Greylight" Stud, Goombungee
C. R. Smith, "Belton Park" Stud, Nara
H. H. Sellars, "Tabooba" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trouts road, Aspley
J. B. Dunlop, "Kurrawyn" Stud, Acacia road, Kuraby
R. A. Collings, "Rutholme" Stud, Waterford
M. Nielsen, "Cressbrook" Stud, Goomburra
G. J. Cooper, "Cedar Glen" Stud, Yarraman
"Wattledale Stud," 492 Beenleigh road, Sunnybank.
Kruger and Sons, "Greyhurst," Goombungee
A. Scott, "Wanstead" Stud, Grantham

British Large Black.

H. W. Naumann, "Parkdale" Stud, Kalbar

Tuberculosis-Free Cattle Herds.

The studs listed below have fulfilled the conditions of the Department's Tuberculosis-free Herd Scheme to 31st October, 1956.

Breed.	Owner's Name and Address.
A.I.S.	M. E. & E. Scott, "Wattlebrae" A.I.S. Stud, Kingaroy
	F. B. Sullivan, "Fermanagh," Pittsworth
	D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth
	W. Henschell, "Yarranvale," Yarranlea
	Con. O'Sullivan, "Navillus" Stud, Greenmount
	H. V. Littleton, "Wongalea" Stud, Hillview, Crow's Nest
	J. Phillips and Sons, "Sunny View," Benair, *via* Kingaroy
	Sullivan Bros., "Valera" Stud, Pittsworth
	Reushle Bros., "Reubydale" Stud, Ravensbourne
	H. F. Marquardt, "Chelmer" Stud, Wondai
	A. C. and C. R. Marquardt, "Cedar Valley," Wondai
	A. H. Sokoll, "Sunny Crest" Stud, Wondai
	W. and A. G. Scott, "Welena" A.I.S. Stud, Blackbutt
	G. Sperling, "Kooravale" Stud, Kooralgin, *via* Cooyar
	C. J. Schloss, "Shady Glen," Rocky Creek, Yarraman
	W. H. Thompson, "Alfa Vale," Nanango
	S. R. Moore, Sunnyside, West Wooroolin
	H.M. State Farm, Numinbah
	D. G. Neale, "Groveley," Greenmount
	Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
	A. W. Wieland, "Milhaven" A.I.S. Stud, Milford, *via* Boonah
	W. D. Davis, "Wamba" Stud, Chinchilla
	Queensland Agricultural High School and College, Lawes
	C. K. Roche, Freestone, Warwick
	Mrs. K. Henry, Greenmount
	D. B. Green, "Deloraine" Stud, Durong, Proston
	E. Evans, Wootha, Maleny
	T. L. and L. M. J. Cox, "Seafield Farm," Wallumbilla
	J. Crookey, "Arolla A.I.S. Stud" Fairview, Allora
	M. F. Power, "Barfield," Kapaldo
	A. H. Webster, "Millievale," Derrymore
	W. H. Sanderson, "Sunlit Farm," Mulgildie
	R. A. and N. K. Shelton, "Vuegon" A.I.S. Stud, Hivesville, via Murgon
	R. R. Radel & Sons, "Happy Valley," Coalstoun Lakes
Ayrshire	L. Holmes, "Benbecula," Yarranlea
	J. N. Scott, "Auchen Eden," Camp Mountain
	E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
	C. E. R. Dudgeon, "Marionville" Ayrshire Stud, Landsborough
	G. F. H. Zerner, "Pineville," Pie Creek, Box 5, P.O., Gympie
	T. F. Dunn, Alanbank, Gleneagle
Friesian	C. H. Naumann, "Yarrabine" Stud, Yarraman
	D. J. Pender, "Camelot," Lytton road, Lindum
	S. E. G. Macdonald, "Freshfields," Marburg
Guernsey	C. D. Holmes, "Springview," Yarraman
	A. B. Fletcher, Cossart Vale, Boonah
	W. H. Doss, Degilbo, *via* Biggenden
	A. C. Swendson, Coolabunia, Box 26, Kingaroy
	C. Scott, "Coralgrae," Din Din road, Nanango
	R. J. Wissemann, "Robnea," Headington Hill, Clifton
	G. L. Johnson, "Old Cannindah," Monto
	A. Ruge & Sons, Woowoonga, *via* Biggenden
	G. Miller, Armagh Guernsey Stud, Armagh, M.S. 428 Grantham
Jersey	Queensland Agricultural High School and College, Lawes
	J. S. McCarthy, "Glen Erin" Jersey Stud, Greenmount
	J. F. Lau, "Rosallen" Jersey Stud, Goombungee
	G. Harley, Hopewell, M.S. 189, Kingaroy
	Toowoomba Mental Hospital, Willowburn
	Farm Home for Boys, Westbrook
	F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line
	P. J. L. Bygrave, "The Craigan Farm," Aspley
	R. J. Crawford, "Inverlaw" Jersey Stud, Inverlaw, Kingaroy
	P. H. F. Gregory, "Carlton," Rosevale, *via* Rosewood
	E. A. Matthews, "Yarradale," Yarraman
	A. L. Semgreen, "Tecoma," Coolabunia
	L. E. Meier, "Ardath" Stud, Boonah
	A. M. and L. J. Noone, "Winbirra" Stud, Mt. Esk Pocket, Esk
	W. S. Conochie and Sons, "Brookland" Stud, Sherwood road, Sherwood
	Estate of J. A. Scott, "Kiaora," Manumbar road, Nanango
	F. W. Verrall, "Coleburn," Walloon
	C. Beckingham, Trouts road, Everton Park
	W. E. O. Meier and Son, "Kingsford" Stud, Alberton, *via* Yatala
	G. H. Ralph, "Ryecombe," Ravensbourne
	Mrs. I. L. M. Borchert, "Willowbank" Jersey Stud, Kingaroy
	W. and C. E. Tudor, "Boree" Jersey Stud, M.S. 498, Gayndah
	Weldon Bros., "Gleneden" Jersey Stud, Upper Yarraman
	D. R. Hutton, "Bellgarth," Cunningham, *via* Warwick
	J. W. Carpenter, Flagstone Creek, Helidon
	H. G. Johnson, "Windsor" Jersey Stud, Beaudesert
	W. S. Kirby, Tinana, Maryborough
	S. A. Cramb, "Trecarne Stud," Lockyer
	G. & V. Beattie, "Beauvern," Antigua, Maryborough
	J. A. & E. E. Smith, "Heatherlea" Jersey Stud, Chinchilla
	W. C. M. Birt, "Pine Hill" Jersey Stud, Gundiah
	T. Nock, Dallarnil
	P. Fowler & Sons, "Northlea," Coalstoun Lakes
	F. Porter, Conondale
	H.M. State Farm, Palen Creek
Poll Hereford ..	W. Maller, "Boreview," Pickanjinnie
	J. H. Anderson, "Inverary," Yandilla
	D. R. and M. E. Hutton, "Bellgarth," Cunningham, *via* Warwick
	W. G. McCamley, Eulogie Park, Dululu
	Wilson and McDouall, Calliope Station, Calliope

Profit and Agriculture

By Dr. W. A. T. SUMMERVILLE, Director, Division of Plant Industry.

Departmental interests embrace not only those of the individual but those of the State as a corporate whole. For the most part these two are coincident but there are times when divergence occurs.

This divergence is brought about essentially by the individual's desire for immediate profit-making resulting in the destructive exploitation of a basic asset in the form of the soil. This asset is something which no State can contemplate being dissipated. Security cannot be divorced from permanence and permanence of agriculture means the maintenance of soil fertility.

There are very few primary producers who would deliberately throw away their capital investment, but this is actually what they are doing when they do not replenish any losses their soil suffers through farming operations.

It becomes a most pressing duty of the officers of the Department to awaken interest and give guidance where destructive exploitation is in evidence.

The evidence need not assume the most blatant form of soil erosion. Apart altogether from that, there is the equally, if not more, important fertility loss which is far more widespread. Farmers and technical officers see the signs day after day in lowered yields, paddocks more and more difficult to work efficiently, heightened adverse effects from drought or wet, and the like.

Plate 1.

The Productivity of the Soil Depends Largely on Soil Structure. Grass should be used more widely in crop districts to prevent soil structure from deteriorating.

Such evidence cannot be ignored even where the economics do not at present exert sufficient pressure to demand change.

Soil is not an inert substance. It is a living organic medium and as such is dynamic and not static. Every time a plant grows in a piece of soil some change occurs. The good farmer and good agriculturist will see that the changes for the worse are counterbalanced. Thus soil husbandry is the most important overall job of the farmer, and in the long term the most fruitful field in which the technical services of the Department can assist.

There are a multitude of ways in which the problem can be tackled, but none so important as through the maintenance of soil structure. Specific cases of loss of fertility may and will call for specific remedies, but these will not long suffice if the structure is lost.

Now there is no other way known to maintain or improve structure which is so efficient as the use of grass. It is indicative of the attitude of the Department that it has, over the past 10 years, stepped up its work on grasses by some 30 times, and it is intended to increase this work still further to the limit of resources.

All the work in grasses is not designed in terms of soil fertility building, but were it not for that aspect much of the potential value of the other aspects would be lost.

Fifty years is a very short span in the life of a nation and not a particularly long period in the life of a family devoted to the land. If, then, we can in say the next 20 years improve our soil husbandry so that a real contribution can be made towards the permanence of our agriculture on individual holdings, and through these to that in our State, it will be a worthwhile contribution. It becomes then a matter of pride as well as duty to study the question of soil utilisation and management to the limit, and a common starting point should be the diversification of agriculture, with grass and its utilisation in the forefront.

A good farmer does not want to hand on to his son a worn-out property on which he will continue to exist only in poverty. Equally, a good Queenslander must refuse to contemplate the future landholders having a bare living from depleted soils. Now is the time to do something about it, and every property is the place on which to work. Purely exploitative agriculture must have no future in this State—it can't last long in any event but in the meantime it can do enormous damage.

JOURNAL SUBSCRIPTION INCREASED.

As from January 1, 1957, the annual subscription for the "Queensland Agricultural Journal" will be as follows:—

Primary producers in Queensland whose main source of income is the land; schools; Schools of Arts; and students—Five shillings.

All others—One pound.

Present subscribers will be required to pay the new subscription rates as renewals become due.

Forage Harvesters*

Compared with other countries, notably the United Kingdom and the United States of America, Australia has made small use of the ensilage process as a means of conserving fodder for stock.

The advent of the forage harvester—a comparatively recent addition to the range of fodder conservation machinery—permits the almost complete mechanisation of ensilage making with a very small man-power requirement and should do much to encourage this means of fodder conservation.

The ensilage process has several advantages which, under low cost operations, make it an attractive manner in which to conserve green crops and seasonal pasture growth. Practically all types of green material can be ensiled with small risk of spoilage, under weather conditions which would make haymaking impossible. Apart from the succulent nature of ensilage, which makes it very palatable and acceptable to stock when pastures are mainly dry, it has the advantages of long storage life without deterioration, reduced risk of loss by fire and freedom from damage by vermin.

One disadvantage associated with ensilage is the difficulty in feeding out, particularly in the case of pit silos. Work is in progress on various means of solving this problem and there is some prospect that suitable equipment for this purpose will become available before very long—whereupon the whole ensilage operation will be completely mechanised.

Whilst the forage harvester has other uses, its main characteristic is that it will mow, cut and load practically any type of green material in the field in one operation under all sorts of weather conditions.

The crop-handling capacity of forage harvesters varies according to type of crop and prevailing conditions but generally ranges from 6 to 20 tons per hour.

The forage harvester has aptly been termed a "large capacity, automatic mobile chaffcutter."

The need for a mobile machine which could gather a crop in the paddock, and at the same time cut it into small particles, is illustrated by the efforts of Mr. N. Pengilly of Canowindra, New South Wales, who in 1925 set about building a machine which would pick up a windrowed crop, cut it into chaff and deliver the chaff to a bagging attachment on the machine.

The nineteen-thirties saw the development of forage harvesters in the United States of America, but it was not until the post-war period that their use became general. The development of attachments which enabled the machine to handle a wide range of crops led to a marked increase in its popularity. The number of forage harvesters in use in the United States rose from 81,000 early in 1950 to 175,000 in 1954 and to 200,000 in 1955.

The introduction of the forage harvester into Australian fodder conservation practices has been slow, but in New Zealand during the last few years there has been a substantial increase in the amount of silage conserved by means of these machines.

*The text-matter of this article is taken from a bulletin issued in January last by the Division of Agricultural Production of the Commonwealth Department of Primary Industry. The illustrations have been provided by the Agriculture Branch of the Department of Agriculture and Stock.

GENERAL CHARACTERISTICS.

Forage harvesters may be divided into three main groups, which differ in the means used to cut the standing crop of green material.

Group A includes the types which make use of a conventional reciprocating knife blade when cutting a standing crop.

Group B uses horizontally rotating cutting blades which also assist in elevating the material into a laceration chamber.

Group C relies for the cutting mechanism on a horizontal rotating shaft from which are suspended cutter blades 7 in. long and 3 in. wide, each attached to two short lengths of chain, or a series of swinging cutter arms.

Group A harvesters usually take the form of a basic unit with easily and quickly interchangeable crop-handling attachments. Row-crop attachments are available for handling row crops, pick-up attachments to gather crops from the windrow or swath, and direct cut (reciprocating mower) attachments for handling standing crops other than tall row crops.

Fitted with the appropriate attachment, the harvester is drawn into the crop, which is gathered, fed to a knife-wheel or a rotary cutting cylinder, cut into small particles and impelled and blown by the cutter through an extended chute to the trailer or truck. Some makes of forage harvesters incorporate separate blower units to deliver the cut material to the trailer or truck, but the majority feature a combination cutter and blower.

Where the knife-wheel principle is used to cut the crop into smaller particles, paddles are fitted to the side of the wheel, converting it into a cutter, blower and impeller. The cutting bars of the rotary cutting cylinder are shaped to act as an impeller and blower.

It is possible to alter the average length of cut by adjustment, but there will still be a substantial variation from the shortest to the longest pieces at any given adjustment.

Group B basic units will handle crops by direct cut or from the swath or windrow. A row-crop attachment is available for handling tall row crops.

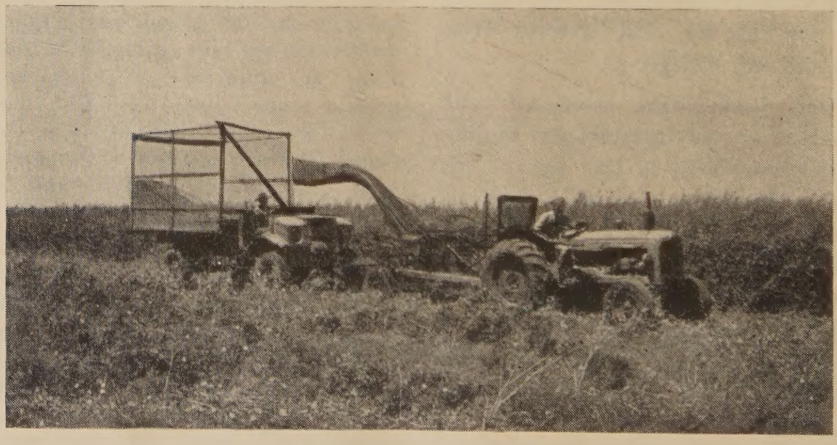

Plate 1.

Forage Harvester Working in a Sorghum Crop in the North-west.

Plate 2.

Harvesting Maize for Silage Near Brisbane.

Plate 3.

Lucerne Being Picked Up from the Windrow and Chopped.

Group C forage harvesters are not provided with special crop-gathering attachments. Whirling chains or arms cut and break the crop into smaller particles and, assisted by the vacuum which they create, lift the crop into the machine, from which it is blown into the trailer or truck.

POWER REQUIREMENTS.

Forage harvesters are powered either by an auxiliary engine or by tractor power-take-off; there is, therefore, a suitable model available within the power range of most farm tractors. The tractor power required to operate an auxiliary engine-powered forage harvester would be 18-26 max. drawbar horsepower, and for a power-take-off forage harvester 28-40 max. drawbar horsepower.

The cutting knives of the forage harvester should be kept sharp as they absorb much more power when blunt. (Some forage harvesters feature inbuilt cutter knife sharpeners.)

OPERATING THE FORAGE HARVESTER.

Forage harvesters are designed for one-man operation, the controls being within reach of the tractor driver, who, if reasonably skilful, can operate the machine and control the filling of the attendant trailer hitched to the harvester.

Besides a forage harvester, some combination of the following items of ancillary equipment is required for the technique:—

Tractor.

Mower.

Side-delivery hay-rake.

One or more trailers.

Motive power for trailers.

Large elevator or blower and power for its operation.

Two basic techniques of storing fodder produced with the forage harvester, and of eliminating one or

Plate 4.

Trench Silo in the Beaudesert District Ready for Filling.

more items of the ancillary equipment mentioned above, are as follows:—

(1) Trench or Pit Silage.

When the silage is to be stored in pits or trenches and haulage runs are short, two men or even one man can store a reasonable amount of fodder using only a forage harvester, tractor and trailer. If wilting of the crop before storing is considered necessary or desirable, a mower and side-delivery hay rake, a windrower, or a reaper and binder without the binding attachment, will be needed.

The forage harvester with its attendant trailer is drawn into the crop until the trailer is filled with the cut silage, when it is uncoupled, towed to the silage pit, emptied, and returned to the paddock.

With two men, an extra tractor and two or more trailers, the time required can be considerably reduced. One man can operate the harvester continuously while the other man empties the trailers, returns them to the paddock, and consolidates the silage in the pit by driving the tractor and trailer over it.

Silage requires less consolidation when cut into smaller particles than when left full length. Consolidation time is considerably reduced if the pit is so constructed that the tractor and trailer can be driven in one end and out the other, over the silage.

(2) Storage in Silos, Sheds, or Stacks.

Such storage with a forage harvester requires the use of the equipment mentioned above, together with a blower or elevator.

Proceed as described for pit storing. At the storage point, back the trailer up to the blower or elevator feed intake, unhitch the tractor and drive the blower or elevator with the tractor belt pulley. (It would, of course, be only necessary to use the tractor when no other power is available.)

Plate 5.

Bun Silo of Red Clover on the South Coast. The outside of the stack is supported by bales of hay.

Plate 6.
Side-tipping Trailer Being Discharged into a Trench.

Plate 7.
Unloading Chopped Forage from a Truck with a False Front. The false front is attached by corner chains to an old tyre. A cable attached to the tyre is anchored to a post set into the ground outside the trench and the load is pulled off as the truck drives through.

When wilting is not considered necessary or desirable, three men with extra trailers and tractor would make a balanced team—one man operating the harvester, one carting the full trailers to the storage site and returning the empties to the paddock, and the third, with the assistance of the trailer operator, emptying the trailers into the elevator or blower and consolidating the silage by trampling it down with the feet.

TRAILERS.

Ordinary tipping-type trucks and trailers are not as satisfactory as trailers fitted with special devices for unloading chopped silage. Chopped silage does not run freely but falls in large clumps which tend to block the elevator or blower feed intake or spill over the sides of the intake. Tipping the truck or trailer gradually and raking the silage into the intake will generally avoid this trouble.

Trailers fitted with special unloading devices are now being made in Australia but unloading devices can be fitted to trailers already on the farm. Two ways of doing this are described here—

(1) Fit a windlass mounted in brackets to the rear of the trailer. Tack to the windlass a full-width canvas of sufficient length to extend from the windlass to the front of the trailer, and of sufficient additional length to wind around the windlass a number of times and to permit a fold of 2 ft. 6 in. in the canvas at the rear of the trailer. Winding the canvas around the windlass a number of times will prevent tearing away from the fasteners. The fold in the canvas at the rear of the trailer will permit unloading of the first portion of the load without dumping a large mass of silage into the blower feed inlet.

(2) A wooden false end with a rope or chain attached can be placed in the front of the trailer. The other end of the chain is attached to the winch placed in a suitable position near the blower feed inlet or to a winch or windlass mounted on the rear end of the trailer. As the false end is drawn to the rear by the chain and winch the silage is unloaded.

To minimise the number of trips between the forage harvester and the storage site it is usual to fit high sides and end-pieces to the trailer. To prevent loss through blower or wind action, a canopy (of sufficient height to prevent interference with the movement of the deflecting chute of the forage harvester) can be built over the trailer.

STORAGE OF ENSILAGE.

It is often advisable to have numbers of storage sites, located as near as possible to the pastures and crops to be cut, in order to avoid long hauls with the trailers. Short hauls not only lessen the number of trailers required but also the time consumed on operations.

Inexpensive and reasonably efficient silos can be made from a variety of materials—for example, bales of hay, wire netting or wire mesh lined with tarred paper can be used to advantage. It is essential that silos made with these materials be well braced against the outward pressure exerted by the settling silage.

To avert the possibility of excessive loss of silage the storage site should be well drained.

Plate 8.

Chopped Forage After Being Dumped into the Trench is Spread and Consolidated by a Tractor With a Farm Dozer Blade.

Silage has been successfully stored in stacks without any cover, particularly when the top layer is of sufficient succulence to decompose quickly and form a seal. Wire netting of sufficient length to extend over the top of the stack and partway down each side and weighted at each end will prevent loss from wind action and assist in consolidation.

A trench silo is a relatively cheap and simple method of storing silage. The trench should be dug on a well-drained site and the ends sloped so that a tractor and trailer can be driven in one end and out the other. The floor of the trench should be slightly sloped towards one end, and a drain filled with stones dug along the centre of the trench floor and extending outside to a sump will drain off the excess silage liquid and any water seepage. To prevent air penetration as the silage consolidates, the sides of the trench should have a batter slope of about 1 foot to 6 feet of depth.

Where a standard wheel tractor is used instead of a 3-wheeled tractor as the towing tractor and as the consolidation medium, care should be taken to make the trench wide enough to run the tractor wheels over the silage in the centre of the trench.

Silage clamps, which are trench-like in form but are built above the surface, make good storage structures, and are valuable when good surface drainage sites are not available. The clamp is also valuable when a reasonably deep trench is not practicable owing to a high water-table.

Plate 9.
Rolling Chopped Sorghum in a Silage Trench.

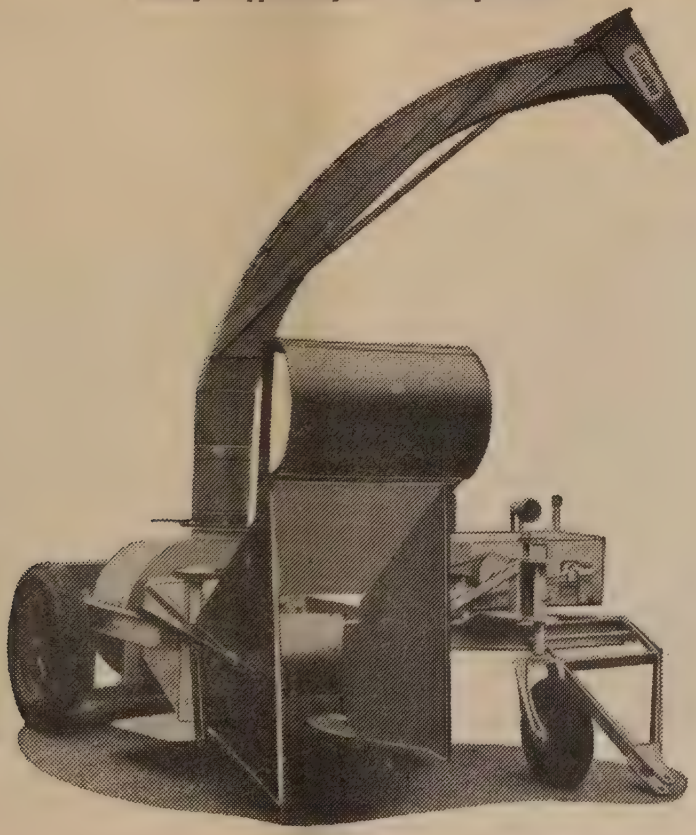

Plate 10.
A Group B Type Forage Harvester.

The two clamps are stood up at the desired distance apart, and suitably braced. When they have been filled and the silage has settled, the clamps, if strongly constructed, can be drawn by a tractor to a fresh site, or drawn to the end of the compacted silage and refilled, thus making a continuous stack.

COSTS.

The forage harvester technique of silage-making is a recent introduction into Australia and no detailed costs of operation are available. However, it is obvious that the cost of the machine, ancillary equipment and labour in relation to the quantity and value of the silage to be conserved is the primary influence.

Two cases of silage-making with the forage harvester are shown as a guide to the time, tonnage and labour involved—

(1) Three men using a direct-cut harvester and two motor trucks ensiled over 220 tons in five days.

(2) A farmer and his 15-year-old son ensiled over 100 tons in 25 hours.

As with the automatic pick-up hay baler, the capital cost of forage harvesters is not low and the small farmer may need to undertake some contract work to make ownership possible. However, the large crop-handling capacity of the machine makes group ownership a possibility.

For those interested in silage making the following information is supplied on capital costs of the various classes of forage harvesters available in Australia.

Group A.—Power-take-off operated forage harvesters with direct-cut attachment range in price from £950 to £1,150. Pick-up attachments range from £200 to £390. Row-crop attachments range from £270 to £475.

Plate 11.

Chopped Forage, Packed into a Block by the Action of the Cutters, being Discharged.

Plate 12.
Harvesting Pasture for Silage.

Plate 13.
Harvesting a Sweet Sorghum Crop for Silage with a Group C Type Harvester.

If the unit is operated by an auxiliary engine the cost would be correspondingly higher.

Group B.—Power-take-off operated forage harvesters cost approximately £610.

Group C.—Power-take-off operated forage harvesters, 5 ft. cutting width, with self-unloading trailer, cost approximately £700.

CONCLUSION.

The large capacity of the forage harvester has encouraged overseas users to cut green material daily for feeding of livestock. They are being used rather extensively to chop and distribute stubble and are invaluable in dealing with heavy maize stubble.

Recent developments in fodder conservation techniques using the forage harvester in the lower rainfall areas of central and south-western Queensland emphasise its value in a fodder conservation programme. Large tonnages of silage have been stored in trench silos and should prove a valuable fodder reserve.

The farmer and the grazier are faced with many hazards, which include droughts, plague grasshoppers and other pests and the ever-present possibility of loss of stored hay by bush or grass fires. In many areas haymaking is limited by seasonal conditions and in any case is fairly expensive. These factors warrant close consideration of the forage harvester as a means of storing adequate fodder reserves.

The capacity for handling any type of crop, the speed of operations and the low labour requirements combine to make it an attractive proposition on many properties. When to these are added the various possibilities for easy storage in stacks, silos, trenches and clamps, and the easier removal of cut and chopped material compared with silage made from long material, the forage harvester will be found to offer a significant advance in fodder conservation techniques.

We Appreciate Your Co-operation.

During the past year, as in previous years, the work of the many Branches of the Department of Agriculture and Stock has been facilitated by the ready co-operation of numerous individual farmers, producers' organisations, commercial firms and other bodies.

The Department is most appreciative of this aid and on its behalf I extend thanks to all those concerned.

I take this opportunity of wishing all readers of the Journal the compliments of the season and prosperity in 1957.

Arthur H. Bell

Under Secretary.

Tobacco Diseases in Queensland

By W. PONT, Pathologist.

I. BLUE MOULD.

Whilst a large number of disorders, both parasitic and non-parasitic, have been recorded on tobacco in Queensland, it is fortunate that relatively few have proved sufficiently serious to be important factors in production. Of these, the outstanding disease is without doubt blue mould.

This is a fungus disease of the downy mildew type which can attack tobacco at any stage of its development from a recently germinated seedling to a mature plant ready for harvest.

SYMPTOMS.

(1) In the Seedbed.

The first indication that blue mould is present in a seedbed is given when patches of seedlings lose their normal green colour and appear yellowish green. A close examination of these affected seedlings will show that the upper leaves have lost turgor and droop, whilst the lower leaves have developed yellowish areas on the under-surface of which a typical grey or purplish down will be found. Although rarely blue in colour, it is this mould-like downy growth which gives rise to the name "blue mould."

If weather conditions are favourable blue mould will spread quickly through the whole seedbed and the diseased seedlings will rapidly collapse. Under such conditions the fungus (*Peronospora tabacina* Adam) will often attack the leaf veins, inducing a dark-brown breakdown of the subsidiary veins or of the midrib. This is more clearly visible on the undersides of the leaves.

In extreme cases the breakdown of the midrib extends into the internal tissues of the stalk and sometimes sunken dark-brown blotches are produced on the fleshy stalks themselves.

If, however, the spell of suitable weather is brief the yellow areas on the leaves of infected seedlings will dry out and the affected parts of the bed will then have a scalded appearance.

Before an adequate control measure was developed for use in seedbeds, blue mould was responsible for chronic shortages of seedlings.

(2) In the Field.

Now that blue mould can be kept under control in the seedbed the most serious aspect of the disease is its occurrence after planting out. Field mould is responsible for losses of leaf during almost every tobacco growing season. The effect on the plant is as follows:

Leaves are infected progressively from the base of the plant upwards. During weather favouring the disease, infections take place very rapidly and the fungus moves quickly up the plant. Large yellow patches often over an inch in diameter appear on affected leaves and the typical mould soon shows on the under-surface of these patches. When the veins are attacked the diseased portions exhibit a dark-brown breakdown.

As the leaf matures the yellow areas dry and eventually the affected tissue falls out either in the field or during the curing process. Badly infected leaf is, therefore, very ragged and its value is considerably lessened.

When a plant is severely diseased the fungus penetrates to the internal tissues of the midrib and from there into the stem. An examination of such a plant will show that there is an internal discoloration of the midribs of the worst affected leaves, which are usually the lower ones. This discoloration extends into the stem and appears here in the outer layers of the woody conducting tissue and in the inner layer of the "bark."

The effect of the invasion of these tissues is shown in two ways.

Secondly, the stalk is weakened and plants affected in this manner are very prone to stalk breaking. A high percentage of lodged plants will usually be found in a crop of tobacco in which blue mould damage has been severe.

When a field of tobacco is exposed to a bad attack of blue mould soon after it is planted out, the internal stem symptoms described above quickly develop, the growth rate of the worst affected plants is considerably reduced, and much unevenness in the stand results.

Plate 1.

Blue Mould. The under-surface of a tobacco leaf magnified about 2½ times to show the mould-like appearance of the spore-bearing stage.

Firstly, due apparently to interference with the normal process of formation of woody tissue, the stalk in the region of the most intense discoloration (which is invariably towards the base of the stem) is often reduced in diameter below what would normally be expected. This shows as a marked constriction of the base of the stem.

METHOD OF SPREAD AND SOURCES OF DISEASE.

Blue mould is spread by spores which can be likened to minute seeds. Like seeds they germinate when their moisture and temperature requirements are satisfied. The common spore form in Queensland is a light, fragile and, of

course, exceedingly small body which is borne in enormous numbers on the surface of an affected leaf, usually on the lower surface.

These spores and the structures which bear them compose the purplish down which is the characteristic feature of the disease. They can be carried by wind currents for considerable distances and are blown or splashed about the seedbed or field. When conditions are suitable they germinate on the plant and initiate fresh infections.

The fungus can produce, also, a second spore form known as the resting spore. This is sometimes found in the remains of leaves which have been killed by blue mould. Little is known so far of the part which this spore plays in originating infections in this State. However, it is possible that blue mould can over-winter in the resting spore stage in crop remains.

In Queensland the fungus is capable of persisting through the winter on living plants such as (1) self-sown seedlings derived from seeding suckers, (2) volunteer plants in various situations, particularly those in the shelter of outbuildings or in other cool or moist places, and (3) suckers from the live underground portions of stalks which have been left standing in the field or which have been rough-ploughed and thereby stimulated into suckering.

That there is an abundance of spores available at the commencement of the season from such sources to initiate seedbed infections has been proved by trapping the spores from the air currents passing over a selected seedbed site.

Centres of infection in the field can be originated by spores from these same sources or from seedbeds already infected in this way. Once the disease gains a foothold in the field it may not be long before the entire crop is infected if weather conditions favour the fungus.

The disease may be carried in or on seed and consequently the use of infected seed is one way in which blue mould may be introduced to a seedbed.

Plate 2.

Blue Mould. The result of infection in a tobacco seedbed.

The blue mould fungus can also infest some plants related to tobacco, including tree tobacco (*Nicotiana glauca*), found growing along the Burdekin River. Here this species serves as an alternative host plant.

CONDITIONS CONTRIBUTING TO AN EPIDEMIC.

As the development and spread of blue mould are closely related to weather conditions, fluctuations in incidence can usually be interpreted by a study of meteorological data taken immediately prior to and during the period in which the disease is active.

So far as temperature is concerned, ideal conditions for blue mould exist when minimum night-time readings approximate 60 deg. F. and day-time readings do not exceed 85 deg. F. When temperatures within these limits are accompanied by high humidities with overcast skies, fog or light rains, a sudden increase in blue mould activity may be predicted. A change to hot, clear days will reduce the activity of the fungus.

The time from the infection of the leaf by a germinating spore of the fungus to the production of a new crop of spores on the leaf spot which develops from that infection varies somewhat, but is generally about seven days. Consequently, a succession of cool, moist periods at about this interval would provide perfect conditions for a major outbreak of the disease.

In North Queensland tobacco growing areas, blue mould can usually be found in some fields at any time during the growing period of the crop. Low night-time temperatures with frequent heavy dews are apparently sufficient to enable the fungus to persist.

Major outbreaks of the trouble, however, appear to be dependent on the occurrence for periods exceeding 24 hours of overcast or drizzly weather with reduced day-time temperatures. Such suitable weather can occur in these areas during the greater part of the year, even sometimes during November.

As a general rule, however, the weather during November, December and early January is not conducive to a flare-up of the disease because it is common to have a succession of hot days with rain only from occasional storms in the late afternoon or evening. The wet season commences in February, sometimes late in January, and rainy days with lowered temperatures can be expected.

In the north of the State, then, blue mould can be a hazard to the irrigated crops which are planted in the seedbeds during the June-July period and which are set out in the field during August and September. Non-irrigated crops which are planted out on the moisture provided by storm rains and which are in the field during late January and February are also exposed to the risk of severe blue mould attack.

The occasional out-of-season crops (that is, winter crops) which have been grown in North Queensland in the past have been at times very seriously damaged by blue mould during moist periods.

In the tobacco growing areas in the south-west of Queensland, the seedbeds are planted up during August, and because of cold weather the crop cannot safely be planted in the field before October. In these areas weather favourable to the blue mould fungus can occur at any time during the growth of the crop.

Whilst blue mould activity in a district is determined by the weather, the incidence of the disease in individual crops in that district even during a period of peak activity is very variable. It is not uncommon to see a badly affected field on one farm adjacent to a slightly affected field on a neighbouring farm.

Tender, quickly growing crops seem more susceptible than crops which have made uniform but less spectacular growth. Plants which have received nitrogen in excess of their requirements are particularly susceptible to blue mould.

A sudden flush of growth also appears to be a predisposing factor. If a field of tobacco which has been backward in growth due to underwatering or to some other adverse cultural procedure is suddenly stimulated into normal growth, severe blue mould injury will result if the crop happens to be exposed at this time to weather suited to disease development.

CONTROL.

Since it is possible for the blue mould fungus to over-winter on volunteer plants and in crop residues, strict attention should be paid to field hygiene. Stalks should be removed and destroyed and their removal should be accompanied by deep ploughing to dispose of leaf remains.

In addition, tobacco should not follow tobacco in any field. It should be grown in rotation with other suitable crops.

The same precaution should be applied to the seedbeds. The seedbed site should be shifted each year and it is recommended that seedbed soil be sterilized by heat or by chemical methods.

In areas where *Nicotiana glauca* thrives, growers should familiarise themselves with the appearance of this plant and attempt to eliminate it.

As blue mould can be seed-borne it is necessary that disease-free seed be used. Such seed is supplied to growers by the Department of Agriculture and Stock. The seed should be sown lightly onto sterilized soil.

Plate 3.

Blue Mould. A volunteer tobacco plant severely affected by blue mould found growing in the vicinity of a new season's seedbed which finally also developed the disease.

The control of seedbed blue mould calls also for the use of a fungicide, and benzol has proved to be a very efficient agent for this purpose. Overnight treatment of the seedbed with benzol vapour enclosed under a vapour-tight cover is the treatment adopted.

In North Queensland, galvanized iron covers or other similar permanent covers are now widely employed. They have the advantage over fabric covers of being absolutely gas-tight and are very durable. Such covers may be constructed to fit beds of any size but they are usually built to cover a bed 10 ft. by 4 ft. and they have sides 1 ft. high in order to give ample clearance above the plants.

Flat iron has proved to be difficult to procure at times and various substitutes have been employed, among them building board and bondwood. In south-western Queensland, calico covers are still used by some growers but are no longer recommended.

The benzol is evaporated from suitable containers supported on stands at a height of 5-6 in. above ground level. The beds are enclosed overnight—from 5 p.m. to 6 a.m. It has been found that the optimum concentration of benzol vapour is obtained when one square inch of evaporating surface is provided for each square foot of bed. The area of the evaporating vessels should, therefore, be adjusted to give this concentration. It is usual to provide at least two containers per bed.

In the case of a 10 ft. by 4 ft. bed, two containers each giving a 5 in. by 4 in. evaporating surface are sufficient. The amount of benzol required for a bed of this size is somewhere in the vicinity of half a pint.

Vapour treatment should be commenced once the seed has germinated, especially if weather conditions prevailing at this time are conducive to the development of the disease. It should not be delayed longer than 10-14 days after germination.

In North Queensland, vapour treatment should be applied to each seedbed every third night and sufficient covers should be on hand to ensure that this is possible.

In south-western Queensland, seedbed covers are generally applied each night to guard against the possibility of frost injury and it is customary also to carry out benzol treatment each night.

It is essential that the disease be kept out of the seedbed. If seedbed control is not complete it is possible that infected seedlings may be introduced to the field. Just a few such seedlings could eventually give rise to a widespread outbreak.

Care should therefore be taken to ensure that the benzol treatment gives all the protection of which it is capable. Covers should be air-tight; the correct quantity of benzol should be used; treatment should commence not later than 5 p.m.; and treatment must be applied as frequently as is recommended.

Control of field blue mould with fungicides poses some difficult problems, not the least of which is the fact that preventive spraying calls for rapid and efficient coverage of both top and bottom leaf surfaces of new foliage and this is difficult to obtain because of the rate of growth of the tobacco plant. Also, spraying becomes progressively more difficult as the plants age. Experimental work in Queensland has not yet found a satisfactory treatment.

Considerable progress has been made both in Australia and elsewhere with efforts to breed a flue-cured tobacco which is resistant to the disease. Some promising types have been developed which embody the blue mould resistance of closely related species of *Nicotiana*, but much work remains to be done before a blue mould resistant tobacco is available for general distribution.

(TO BE CONTINUED.)

Temperature and Fruit Set in the Tomato

By K. M. WARD, Senior Horticulturist.

When grown under good conditions, the tomato plant can be highly productive. Its capacity to set fruit is reduced, however, by a number of factors, among which temperature is of particular importance, although faulty nutrition, adverse weather and inherent plant characteristics may also be involved.

Normal Fruit Setting.

Fruit setting does not normally take place in the tomato plant until the flowers have been pollinated and fertilised.

Pollination involves the transfer of pollen from the anthers of one flower to the surface of the stigma of the same or another flower. Fertilisation occurs after the pollen grains germinate on the stigma and push their pollen tubes down through the tissues of the style to the ovary. Every seed in the fruit is the result of fertilisation by a separate pollen grain.

Fruit setting takes place after the fertilisation of the several ovules in the ovary and is followed by rapid growth in the young fruit.

Influence of Temperature.

In the absence of fertilisation, the flowers do not set and soon drop from the parent plant. Such failure to set may be due to faulty (non-viable) pollen.

Under low temperature conditions, the pollen often fails to germinate, and even if it does so, growth of the pollen tube may be so slow that the ovary loses its receptivity before fertilisation takes place. Under these conditions, too, the ovary itself may not develop even after fertilisation.

Sometimes, partial fertilisation occurs and the fruit is then deformed and contains only a few seeds; such fruit often exhibits the symptoms of "catface."

The processes involved in fruit setting are slowed down considerably at 50 deg. F., and at lower temperatures there is a rapid increase in the amount of blossom shedding.

Blossom shedding or non-setting in the tomato is also commonly associated with high temperatures, especially when these occur at the same time as low atmospheric humidity and strong winds. In these circumstances, transpiration through the leaves is high and so much moisture is withdrawn from the plant that the blossoms wither and die. The best temperature range for germination of the pollen grains is approximately 70-80 deg. F.

Fertilisation may be considerably reduced by temperatures above 80 deg. F. and is unlikely to occur when temperatures reach 100 deg. F. The best temperature for fruit setting is somewhat lower than that for pollen germination and lies within the 65-75 deg. F. range. In hot, dry weather, tomato flowers may be shed irrespective of whether fertilisation has occurred or not; this is particularly noticeable in non-irrigated crops when the soil moisture content is low.

In Queensland, non-setting is often troublesome in tomato crops grown through the winter, especially in the June-August period, when cold winds are not uncommon.

There are several methods of minimising the effects of low temperatures. They include: (*a*) Planting varieties

Plate 1.

Lady Cunningham Tomato at Bowen, a District Where Climatic Conditions are Favourable for Maximum Fruit Set.

which are capable of setting fruit at relatively low temperatures; (*b*) the use of hormone sprays; and (*c*) protecting the crop with windbreaks.

Cold-Resistant Varieties.

Varieties differ a great deal in their ability to set fruit in cool weather. This characteristic is inherent in the variety and it is therefore possible, by selection and cross breeding, to develop types which are capable of fruiting at moderately low temperatures. In addition to being cold-resistant, such varieties must possess the other characteristics required in a good commercial tomato. Work of this kind is in progress at the Redlands Experiment Station.

Several crosses have been made between good commercial varieties which normally set poorly in cold weather and other less attractive types which set well under such conditions. Some of these crosses are: Salad's Special x Q2, Prosperity x Q2, Prosperity x Q1, and Potentate x Stokesdale.

The principal varieties now used in south-eastern Queensland for winter cropping are the small-fruited cluster types such as Salad's Special, Prosperity and a number of local selections. Chinese types such as Rouge de Marmande, Simi and South Australian Dwarf, which produce flat, wrinkled fruit, set moderately well in cool weather but are not very acceptable on the Queensland markets.

Use of Hormones.

The practice of inducing fruit setting in winter by applications of a hormone spray has not yet been adopted commercially in Queensland and is not generally recommended. Nevertheless, it possesses distinct possibilities in areas where healthy, vigorous plants can be grown in the June-August period.

Hormone sprays improve the fruit set when conditions are unfavourable for normal fertilisation of the flowers but are of little value when conditions are suitable for fruit setting.

The hormone most commonly used in experimental work on tomatoes is beta-naphthoxyacetic acid (BNOA), an effective spray being a solution containing 50 parts per million (about one drop in two pints) of the active ingredient. This spray is applied in the form of a fine mist to blossoms which are either open or in the early opening stage and showing the tips of the petals. Periodic spraying is necessary for the treatment of successive flower trusses.

Fruit which has been set by the hormone spray contains few, if any, seeds

Plate 2.

Sugar Cane Windbreaks Protect Tomato Crops From Cold Winds.

but is quite acceptable on some markets. Sprays with a concentration in excess of 50 p.p.m. tend to produce distorted and hollow fruit. Careful preparation of the hormone solution is therefore necessary whenever it is used.

Windbreaks.

Windbreaks reduce the ill effects of cold wind and provide a warmer environment for the fruiting crop. Permanent tree windbreaks on the boundary of the field are desirable on properties which are exposed to cold winds. Such permanent windbreaks may, when necessary, be supplemented by strip plantings of sugar cane, pigeon pea or various shrubs which do not encroach unduly on the cultivated area.

BOOSTING DAIRY PASTURE YIELDS.

Top-dressings of superphosphate and the use of better pasture species are raising pasture yields in Queensland. These two measures are making the biggest improvement to dairy pastures yet recorded in the State.

This is stated in the annual report of the Queensland Dairy Pasture Improvement Committee. With funds provided by the Australian Dairy Produce Board, the committee arranged 130 trials last season. The trials have been laid down in every dairying district from the Atherton Tableland to the New South Wales border. They are supervised by district officers of the Department of Agriculture and Stock.

The merits of top-dressing dairy pastures with a nitrogenous fertilizer are now being investigated in a trial commenced in south-eastern Queensland during the year. Though no conclusions can yet be drawn, large increases in the protein content and yield of the pasture were recorded.

Lack of phosphate has emerged as the greatest single plant food deficiency in coastal pasture soils. Top-dressings of superphosphate have consistently increased yields. In some areas there are indications that potash, molybdenum and copper may also be required, but they are all secondary to the need for phosphate.

The year's trials show that the newer pasture species have brought higher yields in many dairying districts. Typical examples include:—

Successful use of green panic, molasses, grass, and *Glycine javanica* in restoring productivity on worn-out, weedy cultivations and in weed-infested pastures in North Queensland.
Greater plantings of centro in the Mackay and Gympie districts.
Success with phasey bean as a pasture component in many districts.
Use of Townsville lucerne in the Gympie district, either in a mixture with green panic or as an invader of native pastures.

The trials also establish that lucerne is still the most important legume in Queensland. It is a useful component of pasture mixtures as well as being the outstanding hay crop.

In the brigalow country of the Callide and Kingaroy districts, Rhodes grass and lucerne have again proved their value as a perennial pasture. Experimental plantings of green panic-lucerne pastures on parts of the Darling Downs have given outstanding production.

Grazing trials confirmed the value of improved pastures. On the Atherton Tableland, four acres of green panic pasture gave 21 days' grazing compared with eight days for paspalum. At Cedar Pocket, near Gympie, a 21-acre grazing trial has provided as much grazing as the remaining 61 acres of grazing land on the farm.

Members of the committee which plans the whole scheme are: Messrs. T. F. Plunkett, O. O. Madsen, A. G. Muller and A. J. Skinner (M's.L.A.); Dr. W. A. T. Summerville and Messrs. W. J. S. Sloan and S. Marriott (Department of Agriculture and Stock); and Mr. E. J. Lunney (Cheese Marketing Board).

Handling the Cover Crop

By C. N. MORGAN, Senior Adviser in Horticulture.

In subtropical Queensland, the loss of organic matter from land which is used for horticultural purposes is so rapid that cover cropping, at the best, can only be expected to maintain sufficient humus in the soil for commercial crop production.

Soil humus accumulates to a greater extent under established pastures, but on small farms, the inclusion of pastures in the rotation is seldom practicable. Cover crops must therefore be planted at every opportunity.

Most farms are now mechanised and the available equipment includes implements which are capable of turning under cover crops satisfactorily. The value of the cover crop as a soil renovator on vegetable farms, however, can be partly or wholly lost by faulty handling methods which slow down their rate of decomposition. Excessive amounts of raw organic matter in the soil may then interfere with land preparation for the following cash crop.

The Plough.

The plough is the most common implement on the farm. The main types used in vegetable growing areas are the tractor-drawn, double-furrow disc plough and, on smaller properties, the horse-drawn mouldboard plough.

When using the disc plough for turning in the cover crop, the discs should be set to cut wide but shallow furrows. The furrow slice will then be turned completely over and the crop buried. If the cut is deep, the narrow furrow slice is only partly turned over and often part of the cover crop is left on top of the ground. Decomposition is then slow. A further disadvantage in some species, such as white panicum, is their tendency to make regrowth which interferes with cultural operations designed to produce a seedbed tilth.

The furrows should be four to six inches deep and eight inches or more wide. In setting the plough for a shallow cut, the discs are straightened up so that the furrow slice rises against the more or less perpendicular surface of the disc.

When the land is wet or the cover crop is heavy, the discs of the double-furrow plough sometimes become choked with vegetation and cease to function. Under these conditions, it may be necessary to remove the rear disc and plough a single furrow. This is a common practice with tangled, somewhat woody crops such as velvet bean.

On sticky soils, such as the clay loams, good scrapers are needed to keep the cutting edges of the discs clean. Discs which are cluttered up with adhering soil do not revolve freely and tend to push the green matter into a heap ahead of the plough. The operator must then either reverse the implement and take a second "bite" or get off the tractor and spread out the compacted green matter before going on. In either case, time is lost and the work is not done satisfactorily.

Rolling the cover crop before using the disc plough is sometimes necessary in crops which are old and woody. Where difficulty is experienced in handling crops of this kind and rolling is impracticable, a heavy chain may be looped around the front axle of the tractor so that the end trails just in front of the first disc. The chain forces the vegetation down to the ground and holds it there until soil brought up by the plough buries it.

The mouldboard plough handles a cover crop just as well as the disc plough when it is fitted with a sharp disc coulter. The coulter has to be

Plate 1.

Tandem Disc Harrow (Drag Type) Operating in a Cover Crop of Maize.

sharpened frequently on heavy soils, but on sands and sandy loams it retains its edge for long periods.

When the cover crop is rolled beforehand, the horse-drawn mouldboard plough does a better job if it follows the path of the roller; should an attempt be made to plough against the crop, stoppages are inevitable as the green matter builds up in front.

The Tandem Disc Harrow.

The tandem disc harrow is the most popular implement for handling cover crops and is in some respects more efficient than the disc plough.

Various types of tandem disc harrow are available. The offset harrow, for example, is used primarily in orchards where the implement can work under the lower branches of the trees while the tractor travels in the open space between the rows. Offset harrows can, when necessary, be adjusted to follow the tractor.

A second type of tandem disc harrow can only be operated immediately behind the tractor; this implement is frequently dragged behind the power unit but in some models it is directly controlled by the hydraulic lift mechanism. The latter type is by far the most serviceable on small-crop farms.

The type of disc is variable. Some implements have plain discs only; others have scalloped discs in the front gang and plain discs in the rear gang. In a third type, the discs in both gangs are scalloped.

In loams and clay loams, the scalloped discs are preferred not only for turning in the cover crop but also for general cultivation. The plain discs are inclined to lift and ride on the surface when the ground is hard, although they appear to handle cover crops quite effectively on sandy soils and on loams with a reasonable amount of moisture.

The tandem disc is normally used to break down the cover crop some weeks before the initial deep ploughing which is the first step in preparing land for a vegetable crop. In orchards, where ploughing is generally undesirable and unnecessary, the tandem disc is invaluable, for it handles practically any type of cover crop with little or no risk of injury to the roots of the trees.

Tandem disc harrows work best when the cover crop offers some resistance to the cutting edges of the discs; they are much less satisfactory when the ground is wet or the crop is saturated with dew or rain.

The Rotary Hoe.

The rotary hoe is a useful implement for handling cover crops although the smaller models have some limitations in commercial practice. When properly used, the rotary hoe does not bury the crop residues deeply but the green matter is chopped up into small pieces and subsequent decomposition in the soil is rapid. This is an advantage when cultural operations have been held up by wet weather and it is necessary to get the land ready for planting vegetable crops in the shortest possible time.

Tall cover crops should be rolled before the rotary hoe is used. Unlike the plough, this implement is operated against the crop—that is, in the opposite direction to the path of the rollers. As the rotary hoe is more likely to damage the structure of the soil than many other implements, it should, where possible, be used when the soil is moist, not when it is very wet or very dry.

Plate 2.

Tandem Disc Harrow Operated by Hydraulic Lift. On small farms, such equipment minimises damage to roads and headlands. It is highly manoeuvreable.

HOW TO PREVENT WASTE IN TRENCH SILOS.

There's no reason why silage shouldn't keep perfectly for 20 years or more, says Mr. J. L. Groom, Agronomist, Department of Agriculture and Stock. But wastage in trench silos may occur if the silos are not properly sealed.

Silage is pickled grass or crop—pickled in an acid formed during fermentation. Fermentation should use up all the air present in the ensiled material. So long as the acid remains and more air doesn't get in, the silage will remain unchanged. If air enters, the silage will go mouldy. If air and water enter, the preserving acid will be washed out and the silage will decompose.

But you can avoid these troubles. First, in filling the trench, control the temperature at about 100 deg. and pack the silage regularly by rolling with the tractor. Build up the silage so that when it has settled it will be high enough to shed any water that may fall on it. Cover it with an effective seal of at least a foot of earth or sawdust.

After filling, continue to pack the silo daily for about a week and fill any cracks that form in the earth cover. Inspect the earth seal regularly to ensure that there's no risk of water being shed off the main earth cover into cracks along the sides of the trench.

Covering the earth with old galvanised iron appears to do little more than concentrate the rain into a few unprotected spots. The results have been damaging. If you use a temporary roof of this type, lay it carefully and weigh it down. When the silage and earth sink, you may have to re-lay the roof so that it will carry off the rain effectively.

Overseas farmers have successfully used hillside trenches under sheds and protected from surface water run-off. After filling the trench with silage, they use the shed room above for storing hay. Later, the hay and silage are fed out together.

Whatever method of storage you use, this rule stands: Exclude air and water at all times and you're well on the way to success.

WEED TAINTS IN DAIRY PRODUCE.

Weed taints in milk and butter are a real problem in the dairy industry. A Department of Agriculture and Stock survey recently showed that in 1955-56, 97,000 boxes of butter submitted as choice grade were degraded because of weed taint.

Mr. W. D. Mitchell, Dairy Technologist in the Department, points out that this represents 12 per cent. of all choice grade butter officially examined. The survey also showed that taints are more common during the June-December portion of the year.

Before you can adopt control measures, it is necessary to know the weeds that cause the trouble and to be able to recognise them at a glance. The most important one is bitter cress or lesser swine cress, which is found mostly in coastal areas. It is a weed of cultivation, roadsides, yards and waste places. Other weeds are turnip weed, coral berry or turkey berry, peppercress, carrot weed, Hexham scent and fishweed.

You can tackle the problem in three ways—by controlling grazing, by destroying the troublesome weeds, and by sowing down improved pastures.

Where the cows must be grazed in weed-infested paddocks, graze them immediately after milking and remove them at least three hours before the next milking. While this may not remove the taint completely, it will certainly reduce its intensity.

Sometimes you can kill the weeds with hormone sprays. If you are using these preparations for the first time, it is advisable to consult your local Adviser in Agriculture. However, you should bear in mind that hormone sprays are not a substitute for good farming practices.

The most permanent and productive remedy of all is the establishment of permanent pastures. The vigorous growth usually associated with pasture grasses leaves no bare patches for weeds to become established. Improved pastures are a twofold benefit. Besides minimising weed problems and improving the quality of dairy produce, they produce better quality feed which, in turn, gives you higher yields.

A Simple, Rapid Method for Removing Scale-like Deposits from Dairy Utensils and Milking Machines

By W. C. T. MAJOR, Dairy Technologist.

As field observations indicated that the recommended phosphoric acid method for removal of milkstone and water-stone was ineffective in many instances, an investigation was undertaken by the Dairy Research Branch to develop a satisfactory method. The main weaknesses of the phosphoric acid method were found to be:—

(1) In many instances the deposits were not softened sufficiently by the phosphoric acid treatment to allow removal by brushing. Some deposits appeared to be unaffected by prolonged treatment with even hot concentrated phosphoric acid.

(2) When phosphoric acid did attack the deposits the action was very slow, and prolonged vigorous brushing was necessary to remove the treated deposit. This was time-consuming, costly and unattractive to farmers.

NATURE OF THE DEPOSITS.

The deposits referred to in this article are those frequently found where hard waters are used for cleaning with caustic soda, washing soda, soda ash and various proprietary cleaning mixtures containing one or more of these compounds either alone or together with other chemicals. Similar deposits occur with soft water when not enough water is used for the final cleaning rinse.

When such cleaning compounds are used in hard water, chemical scums are formed. Some of these remain in the plant after "cleaning" has been completed. The resultant roughened surface makes subsequent cleaning more difficult.

The final deposit consists of a mixture of chemicals from the hard water, chemicals from the cleaning compound used, and traces of milk solids.

THIS ARTICLE IS NOT CONCERNED WITH SOFT MILK RESIDUES OCCASIONALLY FOUND IN MILKING MACHINES. The presence of such deposits is indicative of gross negligence and utter disregard of the hygiene aspects of the production of human food. They can easily be brushed out of the machine with the assistance of a suitable hot detergent and a brush (preferably a nylon-type fibre brush), and kept out by an honest desire to keep the plant clean.

METHOD OF REMOVAL.

The necessary equipment to remove these scale-like deposits is an adequate supply of:—

(1) Spirits of salts.

(2) Water at not less than 190 deg. F.

(3) Brushes to fit the milk-line and the metal milk and air down-drops, and a "can scrub". Brushes with nylon-type fibre bristles are suitable.

The method is as follows:—

Step 1.

Disconnect the long rubbers from the claws of the teat cups. Remove all of the milk-line down-drops and long rubbers from the machines, except the milk down-drop for the unit furthest from the releaser. Turn off the milk taps. Connect all of the milk down-drops and long rubbers in such a manner as to form a hose running from the end of the overhead milk-line towards the releaser.

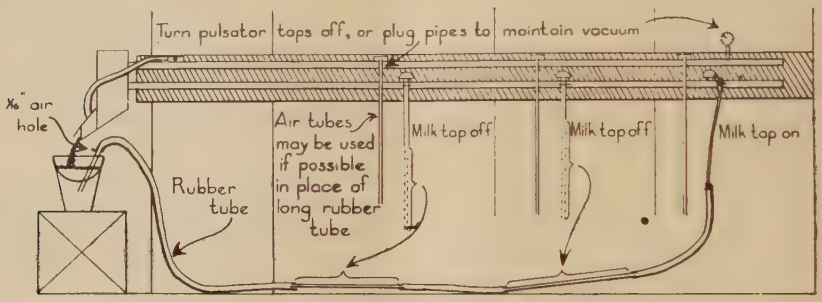
Turn pulsator taps off, or plug pipes to maintain vacuum
⅛" air hole
Air tubes may be used if possible in place of long rubber tube
Milk tap off
Milk tap off
Milk tap on
Rubber tube

Plate 1.

Diagram Showing How the Various Tubes Are Connected to Form a Hose.

Then remove all of the air-line down-drops and long rubbers. Plug the short air-line rubbers, or turn off the air-line taps. Connect the air-line down-drops and long rubbers to the end of the milk-line hose. Place the end rubber in a bucket under the releaser.

Step 2.

Prepare an acid rinsing solution by adding 9 fluid ounces of spirits of salts to 2 gallons of water at not less than 190 deg. F.

Step 3.

Start the plant and add the acid solution to the bucket under the releaser. Open the furthest milk tap and permit the solution to be drawn through the plant. Remove the outer releaser flap and fill the releaser dome. (If the hand is placed on the dome the position of the hot solution can be accurately determined.) Then replace the outer releaser flap and hold it down temporarily to fill the spit chamber of the releaser. Then release the outer flap and permit the releaser to discharge.

While the acid is circulating, rotate each overhead milk pipe an eighth of a turn each 30 seconds. This is necessary, as the overhead milk pipe is only partly filled by the acid solution. Five minutes recirculation is ample, as the acid is usually "killed" within 5 minutes and the temperature of the solution has also dropped considerably.

Draw a milk-line brush through the milk-line each minute during recirculation.

Step 4.

Prepare an alkaline rinsing solution by dissolving 2 level tablespoons of sodium metasilicate in 2 gallons of water at not less than 190 deg. F.

Step 5.

Repeat all of step 3, using the above alkaline solution.

Step 6.

Dismantle the machine and brush the various parts. If the deposit does not easily brush out, repeat steps 2, 3, 4, 5 and 6 until the plant is clean. On bad plants two treatments have been necessary.

Experimentally, much stronger acid solutions (up to 1 part of acid to 3 parts of water) have been successfully used as an initial treatment of machines heavily encrusted with scale. However, the solution strength given above is quite safe for general use in the method outlined. No deposit has yet been encountered which cannot be removed by this method.

Step 7.

To complete the clean-up, remove the various rubber rings, flaps, etc., and soak them and the claws and other metal fittings in hot acid solution for 5 minutes. Then soak them in hot sodium metasilicate solution for 5 minutes. Then brush them.

Step 8.

Reassemble the cleaned plant and rinse with water at not less than 190 deg. F., using 1 gallon per unit.

AVOIDING BUILD-UP OF DEPOSITS.

It is as important to avoid the subsequent build-up of excessive deposits as it is to remove the accumulation at present in the machine.

To keep the machine satisfactory:—

(1) Use as a cleaning solution sodium metasilicate at the rate of 1 level teaspoon per gallon of water, with a wetting agent at the rate of 1 teaspoon per 4 gallons of water.

(2) Use at least 1 gallon of water at 110 deg. F. per unit to flush the machine immediately milking finishes. Allowing milk to dry on surfaces makes subsequent cleaning more difficult. During the initial rinse, flood the releaser dome and spit chamber (as in step 3). The admission of air during flooding causes violent agitation inside the releaser and improves the cleaning. Flooding can most conveniently be done as the last unit water is being drawn into the machine. At the conclusion of this rinse, air is automatically admitted. Agitation for 1 minute is adequate.

(3) Thorough rinsing before the hot detergent solution comes in contact with the metal reduces any tendency for solids to bake on. This is most important in the releaser dome.

(4) It is equally important to use an adequate amount of water for the final rinse to remove all traces of detergent. One gallon per unit should be adequate.

(5) When chlorinated water is used as a pre-milking rinse it is desirable to use a soluble form (sodium hypochlorite), not an insoluble form (calcium hypochlorite). The use of an incorrect form of chlorine can rapidly build up deposits even when soft water is used.

(6) When a slight build-up appears, use an acid in place of an alkali in the cleaner for two consecutive occasions during the standard cleaning procedure. The acid used may be 1 teaspoon of either citric, phosphoric or spirits of salts per gallon of hot water.

(7) It is usually necessary to brush the plant and equipment regularly to maintain a satisfactory standard of cleanliness.

INFLUENCE ON HEAT-RESISTANT BACTERIA.

An examination of farm milk supplies as received at a milk factory showed that many supplies contained more than 300,000 bacteria per c.c. which were not destroyed during subsequent laboratory pasteurisation. The dairies of these suppliers were visited. The plant and equipment was examined and was cleaned

by the method outlined above. Milk samples were subsequently collected at the factory and re-examined. The results obtained are given in Table 1.

TABLE 1.

INFLUENCE OF CLEANING ON HEAT-RESISTANT BACTERIA.

Counts of Heat-Resistant Bacteria. No. of colonies per c. c.	Percentage Before Cleaning.	Percentage After Cleaning.
Above 300,000 ..	80	Nil
Below 300,000 but above 100,000 ..	20	Nil
Below 100,000 but above 50,000 ..	Nil	Nil
Below 50,000 but above 30,000 ..	Nil	20
Below 30,000 ..	Nil	80

Field inspection of dairies supplying milk with a heat-resistant bacterial colonies count greater than 100,000 revealed that in each dairy one or more of the following defects were obvious in the metal or rubber parts of the milking machine, the dairy utensils, cans, or the cooler.

(1) Hard deposits were present.

(2) Soft deposits were present.

(3) Some or all of the rubberware was cracked, fat saturated, misshapen, or sticky.

Field inspection of dairies supplying milk with counts of less than 30,000 showed that the milking machines, dairy utensils, cooler and cans were in a satisfactory mechanical condition and free from hard or soft deposits.

On one farm with an initial count of 200,000, the metal utensils were clean and in good mechanical condition. However, the rubberware was cracked and sticky. When the rubberware was renewed the count dropped to less than 30,000.

SUMMARY.

(1) Hard scale-like deposits can be easily brushed from metal and rubber surfaces after recirculation treatment with a solution of spirits of salts.

(2) Inspection of dairies producing milk with high numbers of heat-resistant bacteria showed the presence of one or more of the following defects:—

(i.) Hard deposits.

(ii.) Soft deposits.

(iii.) Defective rubberware.

(3) Inspection of dairies producing milk with low numbers of heat-resistant bacteria showed the absence of such defects.

(4) Correction of the defects outlined resulted in the production of milk with low numbers of such bacteria.

WARNING.

As spirits of salts (hydrochloric acid) is dangerous and corrosive, every care must be exercised in its handling and storage. Keep it out of reach of children and be careful not to spill any on the skin or clothes of the operator. In using it follow the instructions outlined carefully.

The method is unsuitable for aluminium ware, as it is corroded by spirits of salts.

FEEDING COPPER SUPPLEMENTS.

A time-saving method of feeding a copper supplement to dairy cows in known copper deficient areas is recommended by Mr. D. F. Irvine, Cattle Husbandry Branch, Department of Agriculture and Stock.

For cattle being fed concentrate, prepare the ration by adding 1 lb. of copper sulphate to 250 lb. of concentrate. Feed out the mixture at 1 lb. per head per day.

Temperature More Important Than Distance in Milk Quality

By W. F. SCHUBERT, Dairy Research Branch.

From time to time, the opinion has been expressed that long distances of transport to city depots affects the quality of raw milk adversely.

A survey carried out over a whole year showed that the distance over which milk is transported is of much less consequence than temperature so far as milk quality is concerned.

In other words, if the milk is cooled as soon as it is drawn and is kept cool during transit to the depot, distance does not matter a great deal.

Summer Period.

Table 1 shows that the percentage of unsatisfactory milks in summer was in no way related to the distance of transport. Thus in December 6.32 per cent. of the samples carried 11-20 miles failed and only 2.48 per cent. of those carried 41-50 miles. In November, both of these groups showed approximately the same percentage of failures.

TABLE 1.

PERCENTAGES OF MILKS THAT FAILED THE METHYLENE BLUE TEST IN SUMMER.

Zone. (Miles).	October.		November.		December.		January.		February.		March.	
	No. of Tests.	Failed.	No. of Tests.	Failed.	No. of Tests.	Failed.	No. of Tests.	Failed.	No. of Tests.	Failed.	No. of Tests.	Failed.
		%		%		%		%		%		%
0–10 ..	40	..	50	2·00	40	2·50	37	2·65	37	..	50	2·00
11–20 ..	345	·58	445	1·80	348	6·32	316	11·07	336	7·44	342	3·51
21–30 ..	415	·48	526	2·05	422	5·69	414	6·04	432	4·19	422	5·45
31–40 ..	608	1·32	757	·93	599	4·18	596	10·87	622	4·02	631	1·42
41–50 ..	224	..	290	1·72	242	2·48	252	7·94	238	3·36	254	3·54
Over 50..	135	·75	150	..	90	2·22	117	2·50	122	1·64	118	..
Total..	1,767		2,218		1,741		1,732		1,787		1,817	

HOW SURVEY WAS MADE.

The monthly methylene blue test results of milk supplied direct to a milk pasteurising depot by 236 suppliers were analysed for a period of 12 months. Of the 236 suppliers, 131 were more than 30 miles from the depot and 17 over 50 miles.

SUMMARY OF RESULTS.

The results are summarised in two tables, one covering the summer period (October to March) and the other the winter period (April to October). The tables show the number of modified methylene blue tests made each month and the percentage which failed to reach a 4-hour standard.

The significant fact that comes from this table is that the percentage of failures in each distance zone was low in October when air temperature was about 70 deg. F., then rose steadily until January as the temperature increased. There was some improvement in the hottest month (February), due possibly to farmers observing greater care in production and handling because of the unfavourable reports in January.

The same pattern of a steady rise from October to January is present in each zone, indicating that the effect of temperature "swamps" the effect of distance of transport.

TABLE 2.

PERCENTAGES OF MILKS THAT FAILED THE METHYLENE BLUE TEST IN WINTER.

Zone. (Miles).	April.		May.		June.		July.		August.		September.	
	No. of Tests.	Failed.	No. of Tests.	Failed.	No. of Tests.	Failed.	No. of Tests.	Failed.	No. of Tests.	Failed.	No. of Tests.	Failed.
		%		%		%		%		%		%
0–10 ..	32	18·75	30	10·00	40	5·00	320	6·25	40	..	29	3·45
11–20 ..	334	11·08	339	8·55	419	1·43	340	1·47	435	1·15	319	·94
21–30 ..	410	8·54	413	2·95	516	0·78	386	1·81	487	1·03	283	2·47
31–40 ..	625	11·52	604	2·81	777	0·90	612	4·08	762	0·79	503	0·80
41–50 ..	255	12·55	253	5·53	322	1·86	256	5·84	322	1·52	222	0·45
Over 50..	106	3·77	119	2·51	150	0·67	128	5·42	159	..	120	..
Total..	1,762		1,758		2,224		2,042		2,205		1,476	

Winter Period.

In the winter period, April to September, it is noted first that there was a high percentage of failures during April. This may be attributed to the abnormally high temperatures which prevailed on some days in that month. Also, in the coldest month, July, there were more failures than in June, suggesting that farmers are not so careful in their production and handling methods in midwinter, believing that the low temperatures will keep quality-affecting bacteria under control.

Apart from the April and July figures, the records of failures under the methylene blue test indicate that temperature in the winter period again "swamps" the influence of distance of transport.

Conclusions.

The survey showed two things:—

(1) The percentage of failures in each zone is closely related to the air temperature.

TABLE 3.

COMPARISON OF MILK TEST FAILURES IN SUMMER AND WINTER.

Zone.—(Miles).	Summer.		Winter.	
	No. of Tests.	Failed.	No. of Tests.	Failed.
		%		%
0–10	245	2·04	203	5·91
11–20	2,132	4·97	2,186	3·89
21–30	2,631	3·91	2,495	8·05
31–40	3,813	3·23	3,883	3·39
41–50	1,500	3·20	1,630	4·48
Over 50	735	1·09	782	1·92
Total	11,056	3·48	11,179	4·03

(2) As this relationship was evident in each zone, air temperature is an important factor in milk quality.

The results indicate the overall importance and value of temperature control during production and transit in maintaining milk quality.

The importance of efficiently cooling milk, especially between October and March, is also demonstrated.

How Should We Manage Our Ram Flocks?

By G. R. MOULE, Director of Sheep Husbandry.

The rams you buy to join with your ewes are one of the most important investments you ever make. Besides getting lambs, they can bring you progress that the stud makes each year as the result of its breeding policy.

In comparison with the returns they can bring, rams are a cheap commodity, but that does not mean you can neglect them. The return you get from your investment will depend on how you look after your rams.

Frequently, your lamb-marking percentages will reflect the way you manage your ram flock. High lamb-marking percentages mean you will be able to class your ewes. You will be able to cull the low producers and keep only the ewes likely to give you the highest return. They mean too that you will have surplus sheep for sale. These can be an important source of additional income.

High lamb-marking percentages also mean that you add to your flock each year a fair proportion of young sheep, carrying the most recent progress the stud has made. But how should you manage your ram flocks to get the most out of them?

You Start With Your Fences!

A securely fenced ram paddock is the first thing you need to manage your ram flock properly. If you run ring-lock or 36 in. × 3 in. × 17g. wire

Plate 1.

Good Fences are Essential. This picture shows "the shed" on "Buckinbah" Merino Stud, St. George. Note the ram-proof fence running up to the yards.

[Photo. by "Queensland Country Life."

netting around the boundary of your ram paddock you will be able to keep your rams under control. If you run a strand of barbed wire around the top of this fence you will be certain your rams will not get out!

Most properties have a permanent ram paddock. This is quite a sound policy—except that one ram paddock is not enough. Most woolgrowers allow plenty of room in the ram paddock—perhaps one ram to 10 or 12 acres in what is usually a sheep to 3 acres country. But to get the best use of your country you would be well advised to divide your ram paddock into two.

There are several good reasons why you should do so. But before considering them let us decide upon the site for the ram paddock. There are three essentials to be met:—

(1) Adequate feed and water.

(2) Adequate shade and protection.

(3) Convenience.

The need for feed and water is obvious enough, but not everyone understands the need for shade. Hot weather reduces the fertility of rams. Adequate shade in the ram paddocks helps offset the effects of heat. Likewise, protection from cold winds is an advantage to rams.

If you choose a site for your ram paddock that is convenient to your house and a set of yards, you are in a better position to give the rams the care they deserve. A good mixture of country is an advantage—freedom from grass seed is an essential.

Within sight of your front verandah is one of the best locations for a ram paddock. This gives you a chance to see what the rams are doing from day to day. It makes it easy too for you to check on their water supply and to bring them to the yards for any treatment that may be necessary.

Plate 2.

Shade, Feed and Water are the Important Keys to Successful Ram Management. These three essentials are shown in this picture taken on "Victoria Downs" Merino Stud, Morven.

[*Photo. by "Queensland Country Life."*

How Often Should You Replace Your Ram Flock?

The industry follows two practices:—

(*a*) Buying a complete new draft of rams every four or five years.

(*b*) Buying a set number of replacements—say 25 or 33 per cent. every year.

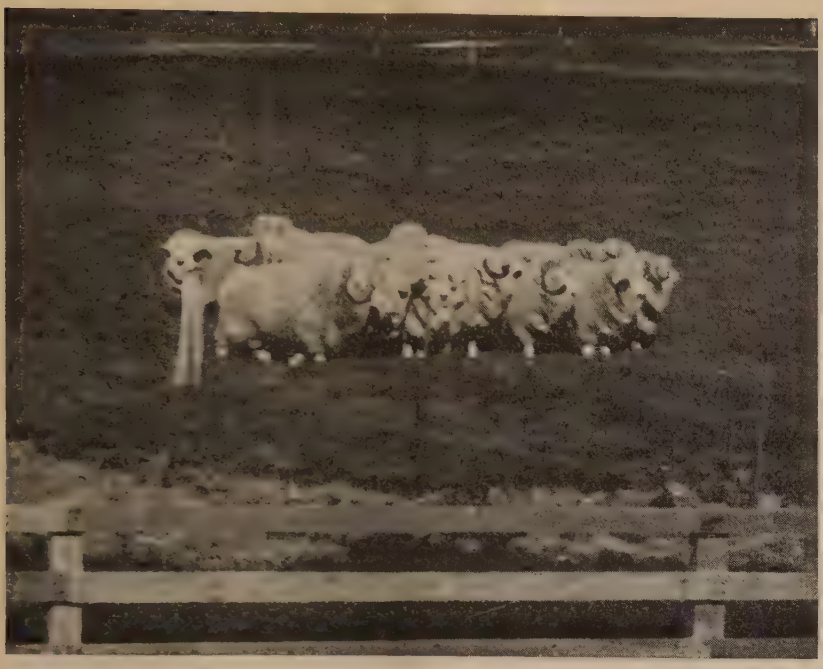

Plate 3.
A Ram Paddock Close to Yards Spoilt by Lack of Shade.

There are many advantages from following the latter practice. The progress you can make from sheep breeding is rather slow. If the stud that supplies your rams is progressing, the rams it offers for sale each year should be just a little better than those it offered last year. By buying each year, you get that little extra progress as soon as it is available.

The useful life of a ram is not very long—it averages about 3 or 4 years—but some lose their fertility earlier; some remain fertile longer. But it is safe to say that as the ram flock gets older, the likelihood of infertility increases (see Plates 4-6). Therefore, keeping your ram flock as young as possible is an important help in ensuring your rams are fertile.

But why are some old rams less likely to be fertile than young ones? This is because of the normal wastage that occurs in any hard-working animals. As rams become older, diseases affect their reproductive organs. Very few rams suffer from these conditions when you buy them; they develop them after they have been mated. The more seasons rams have been mated the more likely they are to become affected by one of these diseases. This is another strong argument in favour of keeping your ram flock as young as possible.

If you buy a draft of rams every year, your stud master knows where he stands. He can hold the rams he knows you will want each year. If you are an irregular buyer, you can't expect your stud master to anticipate your requirements.

How Should You Manage the New Rams?

The rams you buy each year will be delivered two or three months before you need them for mating. They may be "in the wool" when they are delivered. If so, shear them as soon as convenient. If their fleece will be more than five month's growth by the end of the mating season, shear them 6-8 weeks prior to mating.

Put your new rams in one of the sections of your ram paddock specially reserved for this purpose. Here are the two reasons why it will pay you to do this:—

Firstly, your stud will have taken care to be sure that the rams it sent you are free from diseases of the reproductive organs. You might as well try and keep them so until their first

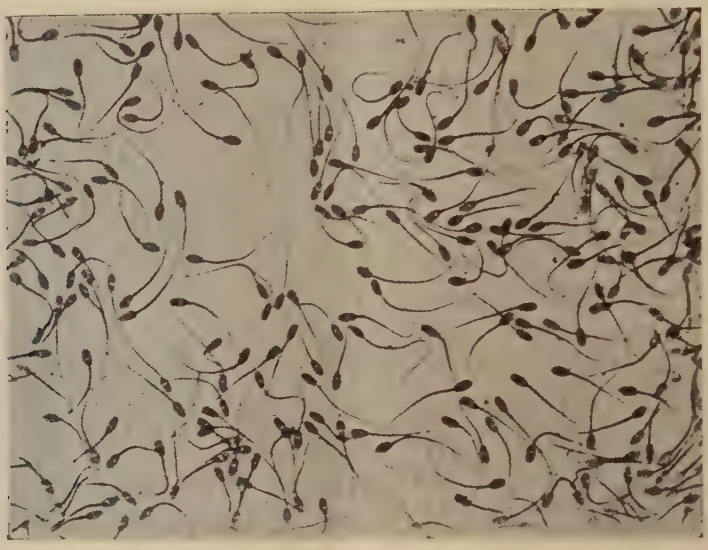

Plate 4.

Normal, Highly Fertile Ram Semen.

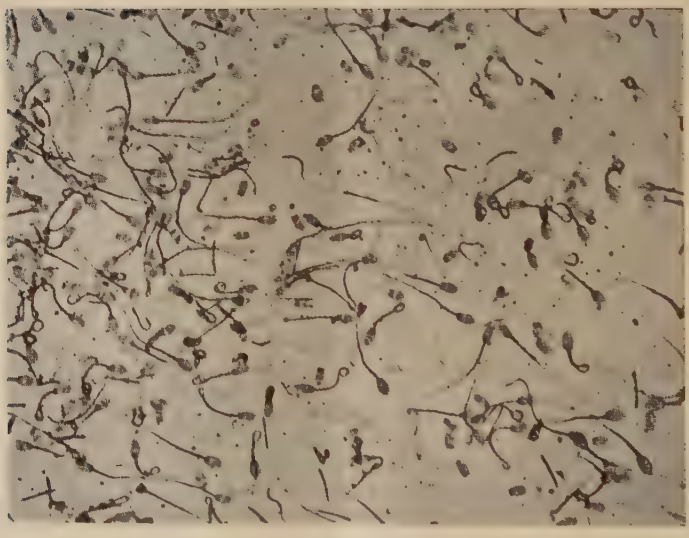

Plate 5.

Semen From a Ram Suffering from Seminal Degeneration. Note the abnormal tails and the heads broken from the tails.

mating. Once the rams are mated they will have been exposed to diseases of this nature.

Secondly, the new rams may be carrying some disease that does not occur in your flock. Footrot is an example. Rams introduced from southern States could harbour the organism that causes footrot. If they happened to arrive during or just before very wet weather, they might spread footrot through your ram flock.

Preparing the Rams for Joining.

Careful attention to your rams two months before joining may help increase your lamb-marking percentages. Here are the main things to check:—

Be sure the rams have short wool but don't shear them in the middle of a heat wave! If you plan a spring mating, shear the rams in the late winter so they can grow sufficient wool to protect them from the sun's rays. If you live in southern Queensland and plan an autumn joining, shear the rams sufficiently early to allow the cuts to heal by a month or so before mating. In both instances be certain the rams go into a shady, well-watered paddock after shearing.

Plate 6.

Be Certain There is Adequate Shade in Your Ram Paddock. Here is a typical example of what is required, on "Burenda" Merino Stud, Augathella.

[*Photo. by "Queensland Country Life."*

If you live in an area where worms occur you may have to drench your rams. There is no point in doing so if you have to put them back into their old paddock. It will help you a lot if you have two paddocks and can move the rams after drenching into one that has been spelled for a few weeks.

While the rams are in for shearing you can check over their feet and trim any that need attention. Check their reproductive organs, too, and discard any rams that are abnormal.

If the weather is dull and cloudy and you live in a district where worms occur, drench your rams. Although phenothiazine is the most expensive drench, it is the most effective and well worth using for rams.

In central and north-western Queensland, many woolgrowers mate their rams during October-November. In these circumstances, the rams may have been on dry feed for five or six months. It is well, therefore, to drench them with a vitamin A concentrate. Vitamin A is essential for the formation of normal sperm. It takes about six weeks for rams that have suffered from vitamin A deficiency to recover their fertility after drenching with the concentrate. There is every chance the feed will remain dry during a spring mating. Therefore, it is advisable to drench them again just prior to joining.

Some woolgrowers jet their rams before they join them. This is more commonly done in the southern part of the State where an autumn joining is more popular, and it is sometimes necessary to protect sheep from fly strike. Protection against fly strike is an all-important part of management of ram flocks. However, there is an essential "don't". Don't use arsenic on rams. Applied as a jet, in a dip or as a fly dressing, arsenic may lower the fertility of rams for two months or so. Therefore, it should be avoided. If you need to jet your rams, use aldrin or dieldrin—they will protect them well from blowfly strike.

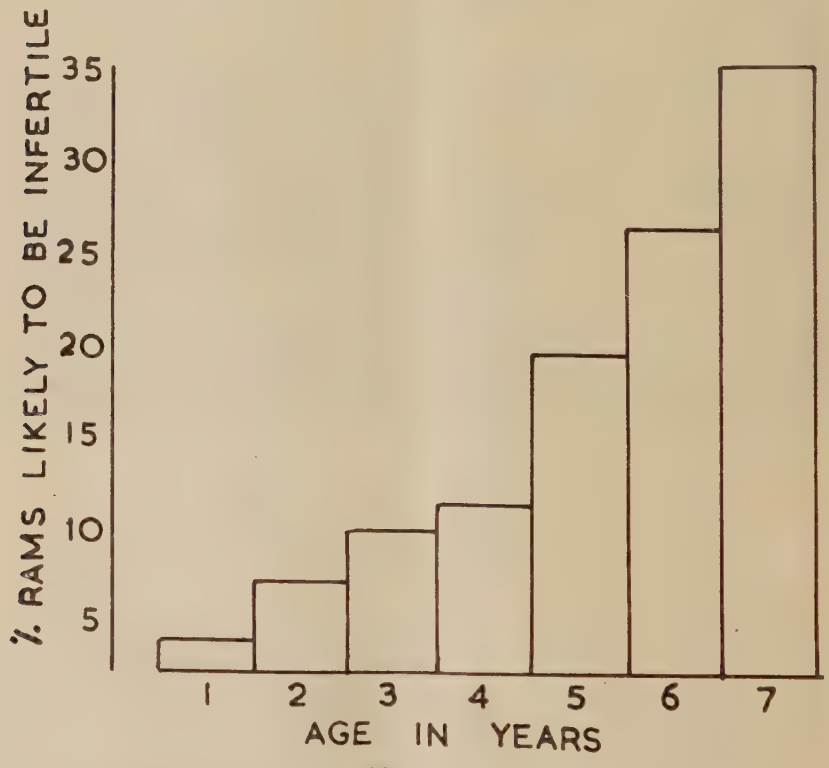

Plate 7.

Diagram Showing How Infertility of Rams Increases With Age. The height of each block represents the percentage of rams likely to be infertile in each age group. The age groups of the rams are shown below each block. The value of each block can be seen from the scale on the left.

Mating the Rams.

Many lambings are ruined the day the rams are mated. Rams need to be kept cool. Driving them long distances during the hot part of the day may make them hot and reduce their fertility. Therefore it is important, if the weather is hot, to move the rams during the cooler hours of early morning or late evening. Transport by motor lorry is the best way of ensuring the rams do not get hot.

Mating the youngest rams with the youngest ewes and the old rams with the older ewes is a practice worth following. The value of this policy lies in the probability that some of the organisms that cause wastage amongst rams may be passed from ewes to rams. Mating the young rams with the older ewes may be exposing them unnecessarily to the risk of infection.

Most woolgrowers mate 2½ per cent. of rams, although this figure varies between 1½ per cent. and 3½ per cent. Provided the rams are good and your property is reasonably well improved, 2½ per cent. is usually sufficient.

Check Your Rams After Mating.

Six or eight weeks after mating is over, check your rams very carefully. Discard any whose reproductive organs are abnormal. Pig bait is the main use of rams discarded for these reasons—and the sooner they are used for this purpose the better. Getting them out of your ram paddock reduces the chance of spreading the organism that causes wastage amongst rams. Picking out the affected rams soon after mating gives you a chance, too, of placing an early order with your stud for replacements.

From Mating to Mating.

Turning your rams out into their paddock and leaving them there until next mating is not good enough. Care and attention to your rams between matings can pay handsome dividends. Here are the key points to watch:—

(1) Protect them from blowfly strike.

(2) Keep them free from lice infestation.

(3) Keep them free from worms.

(4) Keep them in at least good store condition.

If a drought occurs it will pay you to feed your rams a supplement. But don't feed passengers. Go through your ram flock and cull any animals likely to be infertile or that are very old. Feed the remainder a ration fairly rich in protein and vitamin A. Doing this will ensure your rams are in good working order when the drought breaks. They'll need to be in good fettle then to help re-build your flock.

To sum up:—

(1) Select a good piece of country for your ram paddock. Fence it securely. Be sure there is plenty of feed, shade and water.

(2) Keep your ram flock young. Check your rams before and after mating. Cull those that are not likely to be fertile. Order replacements early and keep them separate from your older rams until mating.

(3) If the weather is dry, drench your rams with a vitamin A concentrate six or eight weeks before mating. Drench them again before mating if the weather remains dry.

(4) Keep your rams cool. Work them during the cooler hours of the day; use motor transport if they have to travel long distances.

(5) Keep your rams healthy—free from fly strike and worms. Be sure they are in good, strong condition—not too fat and not too thin for the job ahead.

Grits for Poultry

By H. W. BURTON, Assistant Adviser, Poultry Branch.

The prehistoric ancestors of modern birds were reptile-like creatures which were armed with ferociously toothed beaks. During the course of evolution, the teeth disappeared from the beak and the bird became modified in various ways according to the mode of living and the type of food eaten.

So today we find a variety of beaks—the curved scimitar-like beak of the hawk and eagle for tearing prey, the flattened scoop-like bill of water birds such as the duck for foraging for animal and plant life in ponds and creeks, the long bill of wading birds, and in the fowl a short substantial beak designed to pick up grain, etc.

As fowls swallow their food whole without prior grinding and mastication, we find that the stomach is specially adapted for the purpose of grinding up the food to aid digestion. The part of the stomach concerned in this is the gizzard, a flattish round muscular organ. In grain eating and foraging birds, it is extremely well developed, but in the birds of prey the organ has lost its thick muscular walls.

Grit serves two entirely different purposes in poultry feeding—(1) grinding; (2) mineral food supply—and this has led to quite a lot of confusion in the past.

Insoluble Grit.

Insoluble grit, such as blue metal screenings, quartz and granite, is required to grind and rupture the cell walls of plant foods so as to liberate nutrients such as protein, carbohydrates and fats. The enzymes of the digestive system can then exert their full effect in reducing the highly complex starches and proteins to their simpler components.

Insoluble grit passes into the gizzard, or muscular stomach, where it remains. Aided by the grit, the powerful muscular contractions of the gizzard enable it to function as a mill. In the process, the insoluble grit is gradually ground down and finally voided as small particles of dirt.

Not all grit that appears to come within this class is in fact insoluble. If it contains much calcium (lime), it dissolves in the acid juices of the stomach. Thus grit, if it is to act as an efficient grinding agent, must have the qualities of hardness, durability and insolubility.

Experiments have been carried out with insoluble grit to determine its actual role in digestion. In one instance, the gizzard was removed surgically from birds which were then fed coarse and finely ground mash. Finely ground feeds were digested almost as well as if the gizzard were still present but coarse feeds were much less efficiently digested. This showed that the gizzard plays an important part in feed utilisation.

In more recent experiments carried out in the U.S.A., it was found that chickens without a supply of insoluble grit consumed 10 per cent. more feed than those fed insoluble grit, while adult birds consumed 15 per cent. more feed. This showed that insoluble grit in the gizzard gave better food utilisation by the birds.

Soluble Grit.

Soluble grit, such as oyster shell, shell grit and limestone chips, supplies the important mineral calcium which is essential for proper bone

development in growing stock as well as eggshell quality in the laying hen. It is readily dissolved by hydrochloric acid secreted by glands in that part of the stomach known as the true stomach. It is then absorbed through the wall of the intestine, enters the blood stream, and is conveyed to the glands of the shell-forming part of the oviduct. It is interesting to note that the blood of birds in laying condition contains twice as much calcium as that of birds not in lay.

The ratio of calcium to phosphorus required by chickens for health is accepted as two parts of calcium to one part of phosphorus, while adult birds require up to three parts of calcium to one part of phosphorus. Any variation either way can cause an imbalance and a deficiency leading to ill-health.

An example of a marked imbalance of these elements in a diet occurred recently on a well-managed poultry farm close to Brisbane, rickets being diagnosed. For several years the farmer had fed a high-protein chicken ration containing meatmeal, bonemeal and buttermilk powder. The quantity of meatmeal and bonemeal was sufficient to supply the calcium needs of the chick. This year he substituted livermeal, which is almost calcium-free but very rich in phosphorus, for meatmeal; no extra calcium supplement in the form of shell grit was fed. Despite the fact that vitamin D3 oil was being used, rickets occurred in his chickens.

Under normal conditions, a properly formulated chick starter mash including meatmeal as the source of animal protein will provide sufficient calcium and phosphorus for the chicks' needs. However, to aid bone development small amounts of good crushed shell grit could be added from one week of age onwards with advantage. By the age of eight weeks, 2 lb. of this grit could be given with every 100 lb. of mash.

Adult birds need a readily available supply of calcium at all times, for their requirements vary according to their egg production. Some mashes have calcium supplements included, but additional free choice shell or limestone grit should nevertheless be given, for though sufficient calcium may be available for the mediocre layer, quite often there is insufficient for the good layer. It will be noticed that soft-shelled eggs occur when the supply of shell grit or other forms of calcium is restricted.

From the point of view of grit types, probably the best grit is a brightly coloured medium shell. The birds prefer a medium-sized shell and tend to leave the smaller powder types and larger portions. They are attracted by shiny coloured grit, which no doubt explains this preference over duller oyster shell grit. Powdered grits are not liked by the birds.

It is most important to note that vitamin D3 or direct sunlight is required to ensure proper assimilation of these minerals. Where there is an absence of sunlight—as, for example, in intensively penned birds—a vitamin D3 supplement should be fed.

A deficiency of calcium or vitamin D3 or both will cause retarded growth and rickets in chickens, and a reduction in egg production and hatchability in the case of adult birds.

It has been found that adult birds consume quite large amounts of shell grit or limestone grit when insoluble grit is not available to them, with the result that too much calcium is absorbed into the digestive system and a mineral imbalance occurs. This interferes with the birds' utilisation of calcium and the paradoxical

position may arise where the fowls are actually being deprived of calcium by feeding too much calcium.

Provide Both Grits.

For most efficient food utilisation, a combination of soluble and insoluble grit is clearly necessary. With both chickens and adult birds, ample supplies of soluble grit should be available at all times, and at least under the intensive system of housing, a farmer would be well advised to put a supply of insoluble grit in the rearing and laying pens. This does not mean that no action should be taken on semi-intensive farms. A number of these farms are on light sandy loams or red volcanic soils which are not well supplied with small fragments of insoluble grit, and it should be supplied in such cases also.

USE IRRIGATION WATER EFFICIENTLY.

Heavy rains during the first half of this year provided adequate water for most small crops until early winter. These rains also built up sufficient reserves of irrigation water to supply such crops in late winter and early spring.

However, rainfall since June has been abnormally low, and dwindling water supplies will have to be used efficiently if the present extensive plantings of spring vegetables are to be brought to maturity.

Mr. C. N. Morgan, Senior Adviser in Horticulture, Department of Agriculture and Stock, points out that water use should be governed by the value of the crop, the soil type, and an understanding of crop requirements.

The vegetable grower, under the present circumstances, has to decide priorities for the use of his irrigation water. In coastal districts at this time of the year a large proportion of his crops are approaching maturity or are being harvested. However, some of his land is also under young crops. The grower's dilemma is whether to use available water mostly on maturing crops, or mostly on young crops. If maturing crops are bringing good prices it is considered better to give them, as near as possible, their full water requirements, and to give the younger plantings sufficient only to keep them alive. The latter will usually respond more quickly and effectively than older crops when rain falls. This is especially so if the older crops had previously been deprived of water.

Lighter soils generally allow more rapid penetration of water than heavy types. Less water is needed, therefore, to penetrate to any required depth. Because light soils have a low moisture-holding capacity, water must be applied more frequently than on heavy soils.

Leafy and shallow-rooted crops such as cabbage, lettuce, beans and strawberries require frequent but relatively light applications of water. Root crops, tomatoes, cucurbits and other deep-rooted crops can draw on moisture in the lower levels of the soil. Relatively heavy and infrequent waterings are more suitable for them.

Growers are advised to irrigate late in the afternoon or at night, and to cultivate between waterings. These measures will enable them to conserve water, improve penetration, reduce run-off and control weeds.

The Honey Flora of South-eastern Queensland

By S. T. BLAKE (Botanist) and C. ROFF (Adviser in Apiculture).

(*Continued from page 620 of the October issue.*)

FLOWERING CALENDAR.

Plant.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Banksia				x	x							
Blackbutt		x	x	x								
Black She-oak				x	x	x	x	x	x	x		
Blue Gum							x	x	x	x	x	
Blue Heliotrope ..	x	x	x								x	x
Brisbane Black Wattle						x	x	x	x			
Brisbane Golden Wattle							x	x	x			
Broad-leaved Apple ..	x											x
Broad-leaved Banksia ..	x	x	x	x	x	x	x	x	x	x	x	x
Broad-leaved Ironbark	x											x
Brown Box		x										
Caley's Ironbark ..						x	x	x	x	x		
Dogwood								x	x	x		
Dusky-leaved Ironbark						x	x	x	x			
Flat Weed	x							x	x	x	x	x
Flax-leaved Paperbark											x	x
Flooded Gum			x	x	x							
Forest Boronia							x	x	x			
Forest Oak				x	x							
Fuzzy Box								x	x	x		
Golden Candlesticks ..			x	x	x	x	x	x	x	x	x	
Grass-tree	x	x							x	x	x	x
Grey Ironbark							x	x	x	x	x	x
Grey Mangrove ..		x										
Groundsel Bush ..			x	x	x							
Gum-topped Box ..		x	x	x								
Hairy Bush-Pea ..								x	x			
Hickory Wattle ..								x	x			
Honeysuckle Oak ..				x	x							
Lucerne	x	x										x
Maize	x	x	x								x	x
Mallee Box		x	x	x								
Mexican Poppy ..	x	x							x	x	x	x
Mintweed											x	x
Moreton Bay Ash ..	x	x									x	x
Mugga							x	x	x	x	x	
Narrow-leaved Grey Gum									x	x	x	x
Narrow-leaved Ironbark								x	x	x	x	x
Orange Tree								x				
Paper-barked Tea-Tree		x	x	x	x	x	x					
Pink Bloodwood ..	x	x	x									
Poplar Box	x											x
Prickly-leaved Paperbark									x	x		
Pumpkin	x	x										x
Red Bottle-brush ..								x	x	x		
Red Stringy-bark ..	x	x									x	x
River Mangrove ..										x	x	
River Oak				x	x	x	x	x	x	x		
River Red Gum ..	x										x	x
Rough-barked Apple ..	x											x
Rough-barked Ribbon Gum			x									

FLOWERING CALENDAR—*continued.*

Plant.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Rusty Gum	x											x
Scribbly Gum							x	x	x	x		
Scrub Box	x											x
Silver-leaf Iron-bark ..	x	x										x
Small-fruited Grey Gum	x	x	x									
Spotted Gum						x	x	x	x			
Swamp Mahogany ..	x										x	x
Swamp Messmate ..						x	x					
Swamp Oak									x	x		
Tallowwood								x	x	x		
Tumble-down Gum ..											x	x
Tumble-down Ironbark				x	x	x	x	x	x	x	x	
Turnip Weed	x	x							x	x	x	x
Turpentine										x		
Western Tea-Tree ..	x											x
White Bloodwood ..		x	x	x								
White Bottle-brush ..									x	x		
White Box				x	x	x	x					
White Clover								x	x	x	x	x
White Stringy-bark ..		x	x	x								
Wild May (Bæckea) ..										x	x	x
Wild May (Leptospermum)										x	x	
Wood's Apple	x											x
Yellow Box										x	x	x
Yellow Stringybark ..										x	x	x

NOTE.—The scientific name of the pumpkin grown in Queensland is *Cucurbita maxima* Duchesne, not *Cucurbita moschata.*

(THIS SERIES OF ARTICLES IS NOW CONCLUDED. IT IS HOPED TO PRODUCE THEM IN BOOK FORM LATER.)

THE CORRECT TIME TO RINGBARK.

When you go to the trouble or expense of ringbarking a paddock, you naturally expect to get a worthwhile kill. If you pick the wrong time of the year, however, your efforts will result in little more than a good crop of suckers.

The best time to ringbark, says Mr. S. L. Everist, Government Botanist, Department of Agriculture and Stock, is when the tree is growing vigorously. This is generally when the tree is putting out strong, vigorous shoots or when it is in full flower. At these stages, big demands are being made on the roots to supply the leaves with water and minerals, and there is only a little plant food stored in the roots. Ringbarking is usually most effective if it is done at these times. Bushmen have a name for this stage. They say the sap is up. The bark strips freely and the surface of the sapwood is moist.

In most seasons and with most of our trees, this happens during or immediately after the main wet season, but sometimes the trees make their growth at other times. Find out how your trees behave before you ringbark them.

The aim in ringbarking is to exhaust the roots. You do this by preventing the downward flow of sugars through the inner bark without interrupting the upward flow of minerals and water in the sapwood. The roots of the tree will remain alive by using up their stored food reserves, and when these are all used the whole tree will die, root and branch together.